PATENT SPECIFICATION

617,427

Application Date: May 28, 1946. No. 16212/46.

Complete Specification Accepted: Feb. 7, 1949.

Index at acceptance:—Classes 51(i), B28a; 51(ii), A10, C13; and 78(i), A3.

COMPLETE SPECIFICATION

Improvements in and relating to the Roasting of Sulphide Ores

I, Otto Nordström, of Tegnergatan, 12, Uppsala, Sweden, of Swedish Nationality, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention has reference to the roasting of sulphide ores and the like in furnaces having a burner provided in the top of a funnel-shaped chamber, and particularly in furnaces of the so called flash-roaster type. In such furnaces it is common practice to carry the material to be roasted to the burner by means of the air required for a primary burning operation. Since the speed of the air is forced through the conveying conduit—usually an iron pipe—must be sufficiently high to carry the material when the furnace is driven at a low capacity, the speed of the air will be very much higher when the furnace is driven at a high capacity, and it is unavoidable that the conduit is subjected to a very high degree of wear and tear by the action of the speedily rushing material, especially where the conduit is curved.

The object of this invention is to reduce the wear and tear of the conveying conduit to a minimum, thereby correspondingly increasing the life of the conduit.

The method of the present invention of supplying combustion air and combustion material from a lower level to a burner at the top of a furnace for roasting sulphide ores and the like, as iron pyrites, copper pyrites, for effecting a primary burning of said material in the furnace, comprises dividing said combustion air at said lower level into two streams, passing said streams from said lower level through separate ducts, introducing the combustion material into one stream so as to be carried thereby said last-mentioned stream of air being so proportioned as to be capable of carrying said material to the burner at the minimum rate of flow required for lifting the material from said lower level to the level of the burner, whilst the other stream consists of the remainder of the air required for effecting the primary burning operation.

Due to the fact that the material under all working conditions of the furnace moves through the conveying conduit at a minimum rate, the wear and tear as exerted on the conduit by the material will also be reduced to a minimum. Above all, deep scoring of the conduits is avoided, which otherwise occurs when the material is thrown from one side of the conduit to the other where the conduit forms a curve. But also in straight portions of the conduit the wear and tear is considerably reduced by the low rate, as practical experiments have proved. In order to allow the operator to determine how great a fraction of the quantity of air required for the primary roasting operation he may use for conveying the material, the conveying conduit is provided with an extension at its lower end, leading to an otherwise tightly closed box the interior of which may be inspected through a window. The mouth of said extension opening into the box is provided with a closing valve that may be controlled from outside the box. By opening this valve the operator may observe whether or not any material drops from the conveying conduit into the box. He may then easily adjust, by appropriate means, the supply of compressed air to the conveying conduit until material no longer drops into the box. The operator now knows that all the material fed to the conveying conduit is carried by the air to the burner. He may then slightly reduce the supply of air to the conveying conduit until particles of the material begin to drop into the box, and then slightly increase the supply of air to the conveying conduit. In this way it is possible to

[*Price* 2/-]

adjust the supply of air to the conveying conduit more nearly that required just to carry the material under consideration to the burner, the additional air required, if any, being supplied through the separate air conduit or conduits.

In the accompanying drawing an embodiment of the invention is shown diagrammatically. Fig. 1 is a vertical section of the furnace with a material conveying conduit and an additional air conduit. Fig. 2 is a side elevation on a larger scale of the lowermost portions of said conduits and their connexion to a fan and to the inspection box. Fig. 3 is a plan view of Fig. 2 with certain parts removed.

Centrally positioned at the top of a funnel shaped roaster-furnace 1, Fig. 1, is a burner 2, to which the material to be burned, as for instance, iron pyrites or another sulphide ore, is fed in a finely divided state together with a sufficient quantity of air to effect a primary burning of the material. Inserted in the bottom of the furnace is a nozzle 3 for the admission of secondary air. The burner and said nozzle are, preferably, constructed to cause a rotary movement of the material and air within the furnace chamber, as indicated in the drawing. Connected to the burner are three conduits, one of which, 4, is a conveying conduit for the material to be roasted, another, 5, being an additional primary air supplying conduit, and the third, 6, being a circulation conduit for admitting cooled gas to the burner to reduce the temperature of combustion within the furnace.

The conveying conduit 4 and the additional air conduit 5 are parallel conduits, both of them being in communication at their lower ends with a valve chamber 7, in turn connected to the delivery end of a fan 8 and containing a damper 9 or another valve by means of which the compressed air as delivered by the fan may be distributed to the conduits 4 and 5 in any desired ratio. The intake of the fan 8 is connected through a conduit 10 to an air heating jacket 11 surrounding the side wall and top of the furnace which is open to the atmosphere at its lower end. Under the action of the fan atmospheric air enters said jacket at the lower open end thereof and is heated by the hot wall and top of the furnace so as to enter the conduit 10 in a heated state.

Leading to the lower point of the conveying conduit 4 is the discharge pipe 12 of a feeder 13 which receives finely divided material, as for instanse, iron pyrites through a hopper 14 and delivers it through pipe 12 to the conduit 4. In front of its connexion with the valve chamber 7 and below its connexion with the feeder 13, the conveying conduit 4 is provided with an extension 15 ending in a hermetically closed box 16. The lower end of said extension is normally closed by a plug 17 which may be controlled from outside the box by means of a handle 18. Mounted inside box 16 is a lamp 19. Placed on the bottom of the box is a receptacle or trough 20 for receiving solid particles dropping from the extension 15. Provided in the wall of the box opposite the mouth of the extension 15 is a window 21 through which the interior of the box may be readily observed.

At their other, that is, upper ends the conduits 4 and 5 are connected to the burner in the following way. Pipe 5 is connected to a pressure equalising chamber 22 the bottom of which is provided with an outlet leading to the burner which comprises a funnel-shaped upper portion 23 and a tubular lower portion or nozzle 24 projecting into the housing of the burner 2. Pipe 4 enters the pressure equalising chamber 22 through the top thereof and extends to adjacent a point where the funnel-shaped portion 23 merges into a tubular nozzle 24. Pipe 6 is connected to the burner housing 2 in a tangential direction so as to effect a rotary motion of the gas around the nozzle 24. Pipe 6 leads from the outlet of a fan 25 the intake of which is connected to the gas outlet 26 of a heat exchanger 27, as for instance a boiler, coupled to the furnace. The cooled gas as supplied through pipe 6 serves, as already stated, to reduce the temperature of combustion in the furnace to a suitable value.

The operation of the plant described is as follows:

The fan 8 takes pre-heated air through pipe 10 from jacket 11 and delivers it at a suitable pressure to the valve chamber 7. Thence the compressed air is passed either to pipe 4 or pipe 5 or is distributed to both of them in a desired ratio as determined by the position of damper 9. By means of the feeder 13 finely divided material to be roasted in the furnace, such as for instance, iron pyrites, copper pyrites, or the like, is fed from hopper 14 to pipe 4, where the material is caught by the air passing through said pipe and conveyed up to the burner. The material thus discharged from pipe 4 is delivered to the nozzle 24 where it encounters the air passed to chamber 22 through pipe 5. The compressed air thus supplied through pipe 5 is subjected to a pressure equalization in chamber 22 whereby this

air is allowed to surround uniformly the stream of air and finely divided material as discharged from pipe 4. In the nozzle 24 the added air from chamber 22 is mixed with said stream and in the burner proper the resulting mixture of air and material is diluted by the circulation gas supplied through pipe 6. Owing to the tangential entry of said gas into the housing of the burner and the construction of the burner the whole mixture is caused to rotate, so that the combustion gases also will rotate within the furnace chamber, as indicated by a spiral line in Fig. 1. In this manner the total amount of primary air is mixed with the material to be roasted as though all the primary air together with the material had been supplied through the pipe 4 only.

The control of the distribution of air to the two pipes 4 and 5 by means of the damper 9 may be carried out, for instance, in such a way that at the lowest capacity of the furnace the entire stream of air as discharged from the fan 8 is supplied to pipe 4 and thus wholly utilised for conveying the material to be roasted. The speed of the fan should in such case be so adjusted that the rate of air passing through pipe 4 will be sufficient only to allow the air to convey the material. When operating at a higher capacity, that is to say, with a larger supply of material to be roasted, the furnace requires an increased supply of primary air, and in such case only a fraction of the air required is passed through pipe 4, viz. only such a quantity as is required to carry the material at the lowest rate, the remaining air being passed separately to the burner through pipe 5.

In order to allow the operator to effect the distribution of the air between the two pipes in the proper way, he may observe through the window 21 whether or not any particles of material drop into the box 16 when the plug 17 is removed from the mouth of the extension 15. If no particles of material drop, the operator knows that the air passed to pipe 4 is sufficient for carrying the material. In order, however, that not too large a portion of the air supplied by the fan 8 may be used for effecting the conveying of the material, the operator should reduce the supply of the air to pipe 4 until particles of material begin to drop from the extension 15 down into the box 16. He should then open the damper 9 by a slight amount, so that the admission of air to pipe 4 is increased in a small degree and the dropping of material into the box ceases. The amount of air admitted to pipe 4 may in this way be adjusted as nearly as possible to the value required for carring the material up through pipe 4 at the minimum rate. As a result, the wear and tear on the pipe will be reduced to a minimum.

The material dropping from the extension 15 into the box 16 collects in the container 20 and may be again introduced into the course of operation by removing the container and emptying it into the hopper 14.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A method of supplying combustion air and combustion material from a lower level to a burner at the top of a furnace for roasting sulphide ores and the like, as iron pyrites, copper pyrites, for effecting a primary burning of said material in the furnace, which comprises dividing said combustion air at said lower level into two streams, passing said streams from said lower level through separate ducts, introducing the combustion material into one stream so as to be carried thereby, said lastmentioned stream of air being so proportioned as to be capable of carrying said material to the burner at the minimum rate of flow required for lifting the material from said lower level to the level of the burner, while the other stream consists of the remainder of the air required for effecting the primary burning operation.

2. Means for carryng out the method claimed in claim 1, characterised by the fact that two conduits at least (4, 5) are each connected at one end via a common distributing valve (9) with a fan or other source of compressed air (8), one of said conduits (5) leading directly to the burner (2), while the other conduit (4) has connected thereto a feeding device (13) for the material to be roasted, said lastmentioned conduit (4) being further connected at its upper end to said firstmentioned conduit (5) in front of a nozzle (24) extending into the burner so that the air supplied through pipe (5) is caused to mix with the stream of air and material supplied through pipe (4) before reaching the burner.

3. Means as claimed in claim 2, characterised by the fact that said other conduit (5) is connected at the burner to a pressure equalising chamber (22) surrounding the respective end portion of conduit (4) and which is connected to the nozzle (24) in such a way as to allow the air entering the chamber (22) from conduit (5) to distribute itself uniformly around the mouth of conduit (4) before entering the nozzle (24).

4. Means as claimed in claim 3, characterised by the fact that the pressure equalising chamber (22) is connected to the nozzle (24) by means of a funnel-shaped transition member (23).

5. Means as claimed in claim 2, characterised by the fact that the material conveying conduit (4) is provided at its lower end with an extension (15) leading to an otherwise hermetically closeable box (16) having a window (21) through which an operator may observe whether any material from conduit (4) is not carried to the burner but drops into the box so that he may adjust the admission of compressed air to conduit (4) until no material is dropping into the box.

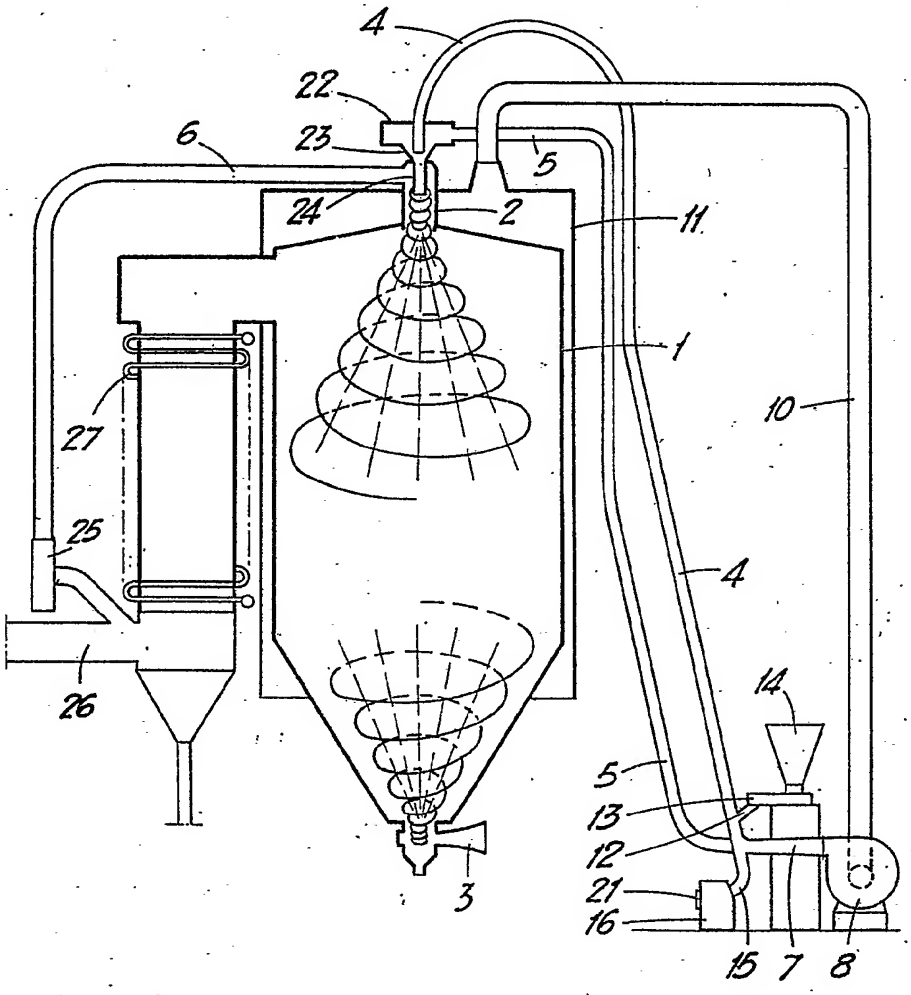
6. Means as claimed in claim 5, characterised by the fact that the extension (15) projecting into the box (16) is provided with a closing device (17) that may be controlled from outside the box, the box further containing a removable trough (20) or the like for collecting material dropping into the box from extension (15).

Dated this 28th day of May, 1946.
CRUIKSHANK & FAIRWEATHER,
29, Southampton Buildings,
Chancery Lane, London, W.C.2;
and
29, St. Vincent Place, Glasgow,
Agents for the Applicants.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1949.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies, price 2s. 0d. each (inland) 2s. 1d. (abroad) may be obtained.

[This Drawing is a reproduction of the Original on a reduced scale.]

FIG. 1.



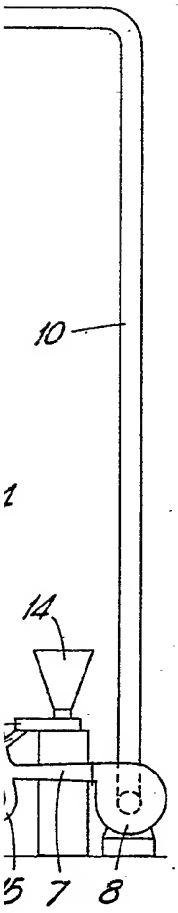


FIG. 2.

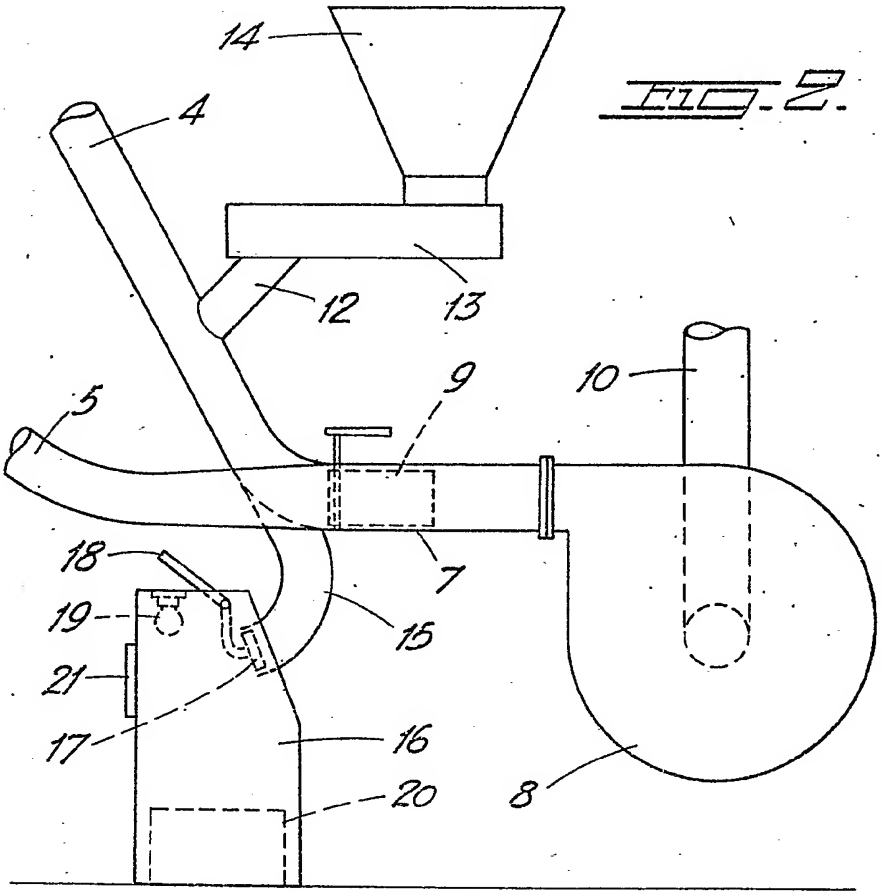
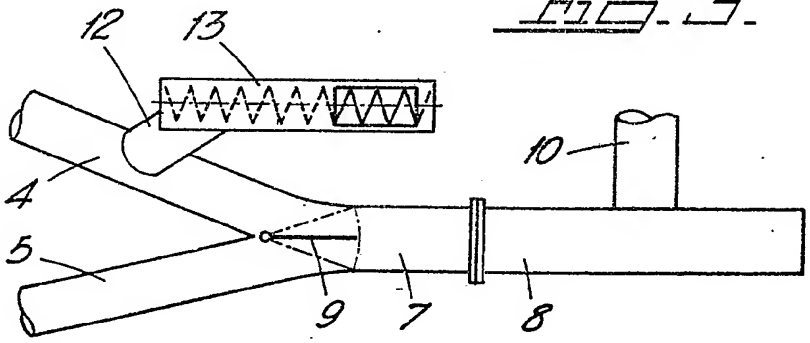


FIG. 3.



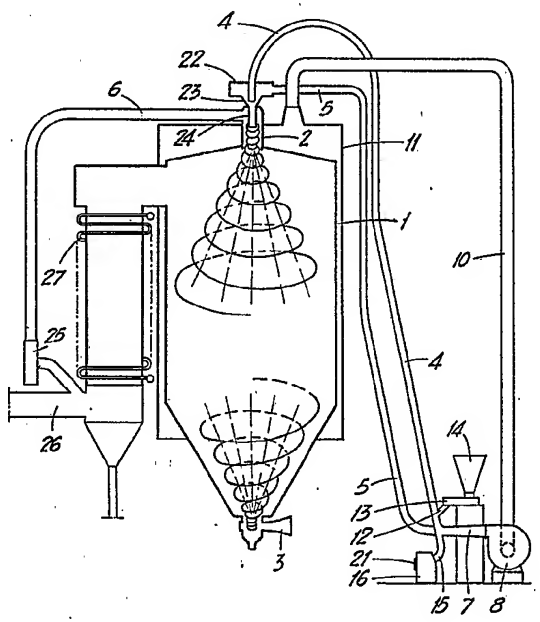
H.M.S.O. (Ty. P.)

617,427 COMPLETE SPECIFICATION

2 SHEETS

SHEET 1

FIG. 1.



SHEET 2

FIG. 2.

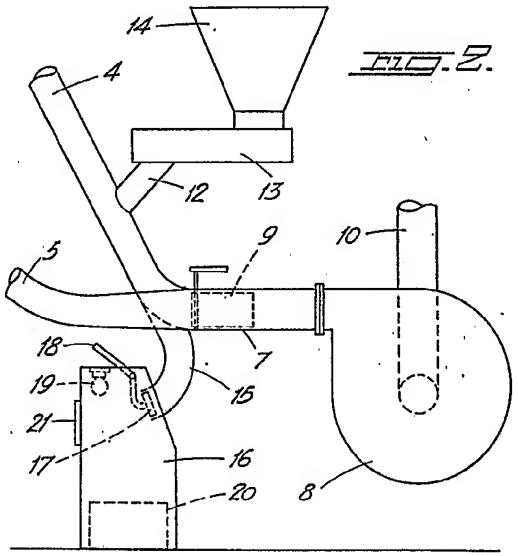
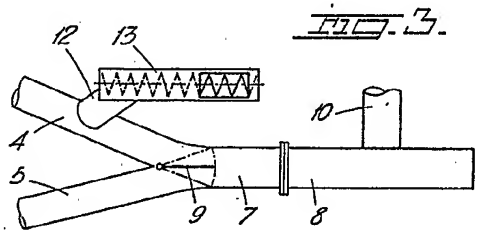


FIG. 3.



[This Drawing is a reproduction of the Original on a reduced scale.]

H.M.S.O. (Ty. P.)